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Need

Nine out of ten workers must toil to raise food in some countries. Even so, millions don't get enough to eat.

Men the world over are straining to raise living standards by more productive use of natural resources.

Putting science into agriculture can multiply these resources many times, as United States farmers have proved so brilliantly over the last 20 years. The gains in farming are commonplace: Machinery, improved practices, fertilizer, pesticides, more productive plants and animals, weed killers, and so on. And it seems as though the total is even greater than the sum of these gains—that is, there seems to be an extra dimension that comes from the expanding pool of technical knowledge.

Can we share our agricultural technology with others?

In highly industrialized countries like this, our technology can be used much as it is. Education, communications, and transportation keep our people in close touch with the world. And farmers' needs for supplies and services are served by a complex network of industries and institutions.

On the other hand, many underdeveloped countries can't use our technology. Cheap labor is often the biggest resource. Power is furnished by humans and animals, and each farmer works only a few acres. Much of the population cannot read.

But such countries can still gain much from us. They can draw on our experience to help improve their schools and colleges—and develop their own teachers, scientists, farm advisers, economists. They can draw on our knowledge to help improve their research—and solve their own problems in soil and water use, breeding of crops and livestock, farm management.

We have been providing technical assistance through the International Cooperation Administration and other avenues in recent years. Now, many countries have opportunities to share the benefit we expect from our support of studies abroad under Public Law 480 on credit from sale of surplus commodities.

So it seems we have been instrumental in putting science into the service of many people. In a way, it's repayment for the knowledge that well-established countries have shared with this developing land over the last 2 centuries.

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How Our Scientists View

RUSSIAN AGRICULTURAL RESEARCH

RUSSIAN WHEAT is inspected by agricultural scientists on their recent trip to Soviet Union. They include (left to right): John Kirkbride, Carl Heisig, Sherman Johnson, Lazar Volin, Harold Breimyer; G. G. Kotov, deputy director of the All-Union Research Institute of Agricultural Economics, at Moscow.

Six teams of American scientists touring U. S. S. R. farm regions saw evidence that progressive research is building up a strong agriculture in that country

AGRICULTURE IS NOW ADVANCING rapidly in Russia—a act that can be attributed largely to the nation's progressive agricultural research. This is the observation of x USDA-sponsored delegations that got a firsthand look t the agricultural research and farm practices of the oviet Union last summer and fall.

Scientists from ARS and other department agencies, nd from land-grant colleges and industry, found that reat strides are being made in many areas. Research s helping to increase mechanization, open up new lands or food-grain production, increase cotton output, and eep ahead of animal diseases. Although the Russians re still behind us in meat and milk production, they're losing the gap through effective research. Their stated im is to gradually surpass us within 5 years.

On the negative side, plant breeding suffers through lack of greenhouses. Many laboratories aren't well equipped. Little emphasis is put on research in pest control and the development of pesticide materials; and as a result, leaf rusts, nematodes, plant pests, and viruses take a heavier toll than necessary.

These 1958 visits of our scientists to Russia were the result of an agreement between the two countries announced in January 1957, providing for exchanges in cultural, technical, and educational fields. Teams in agricultural economics, crops, soil and water use, veterinary science, farm mechanization, and cotton growing and plant physiology visited Russian farms, research stations, and state farms. Russian agricultural scientists visited this country at the same time. **TURN PAGE**

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RUSSIAN AGRICULTURAL RESEARCH
(Continued)

Major cattle-breeding effort is to improve the dual-purpose cow—increase the present 3- to 4-percent butterfat and the rather low production level of about 4,000 pounds of milk per cow per year. Research-based artificial insemination is widely practiced with cattle, sheep, horses, and hogs, and is obligatory where trichomonad parasites and brucellosis are present. There's little broiler research and not many broilers are produced. Chickens are eaten only when they stop laying.

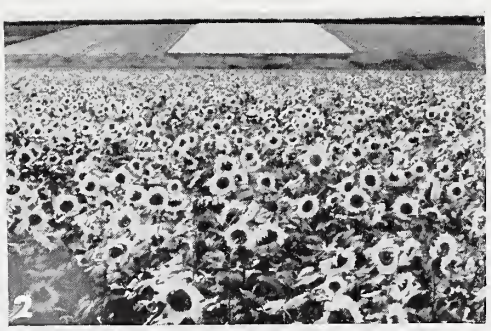
The Soviet Union has about the same animal-disease problems, and studies them in about the same way as we do. In addition, Russian veterinarians must combat fairly widespread foot-and-mouth disease.

Principal disease-control research is directed toward immunization, judging from the high priority given to control of the production of biologicals. Most biologicals known here are known in the Soviet Union and improvements are adopted promptly. Our veterinarians feel that on the whole, Russian research in veterinary medicine may lag behind ours for the time being.

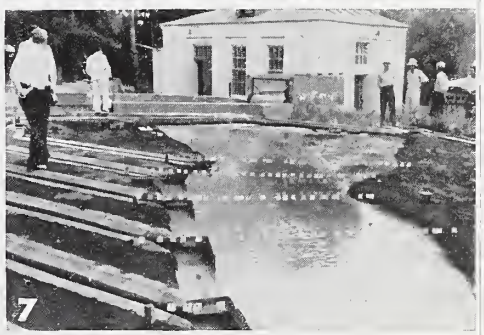
Best progress in crops research has been made in plant breeding, especially on annuals. Most breeding is now largely based on conventional methods of hybridization and selection, although the Lysenko belief in heritability of acquired characters is still thought to be hampering progress in this field to some extent.

Sunflowers, hybrid corn are being pushed

Much research has gone into development of the oil-rich sunflower that supplies 60 percent of the Russians' vegetable-oil needs. About 11 million acres are devoted to this outstanding crop. Corn production is receiving special attention and Russian scientists have developed their own inbred lines partly from our parent stocks. No unfamiliar crop material that offered economic potential for the United States was noticed anywhere.



1. Specially selected, dual-purpose Red Steppe breed cows give 11,000 pounds milk, 3.96 percent butterfat; Soviet's average production is considerably less. **2.** Sunflowers are outstanding research development, and Soviet's top vegetable oilseed crop; much progress has been made in breeding disease-resistant varieties. **3.** Tractor pulls experimental ditching machine—for ditches 30 to 40 inches deep—at drainage area near Minsk. **4.** Cotton plants are studied to determine effects of rain on growth and quality. **5.** Scientists inspect rice varieties at Kuban Rice Station in Ukraine republic. **6.** Lysimeters measure water percolation in peat soil that's planted in potatoes at experimental station of Amelioration Institute in Republic of White Russia. **7.** Design at Institute of Water Economy at Tashkent is for removing irrigation water without dam; machines continuously remove the "silt" from the canal heads.



The Soviet Union doesn't have a surplus-production roblem. So there's little incentive for research on new ses for present crops. Utilization research is centered nder the Academy of Sciences rather than the Ministry f Agriculture. Cotton and tobacco are being studied in he Academy as sources of citric acid, and wild plants as ources of medicines, resins, and industrial oils.

oviets lag in development of pest controls

Research on plant-pest control isn't well developed.)DT and benzene hexachloride are being used for insect ontrol in orchards and on vegetables; bordeaux mixture largely discarded in this country) and other copper ungicides are employed for field control of diseases.

Our scientists think the Russians are doing good basic esearch in soil and water use. Team members expressed especial interest in a new-type bacterial fertilizer and an norganic phosphorus supplement.

Cotton experts feel that the planned Russian increase n cotton output—50 percent in 7 years—is too optimistic, but their researchers are attacking this problem on several sides. Research has already helped make Russia the second largest cotton producer in the world.

Our farm mechanization team was impressed with the topnotch farm machinery—such as self-propelled combines—that is now coming off the assembly lines. But many of the steps in mechanized farming are not being well integrated. The intermingling of the old and new was emphasized many times. In the same fields with modern combines, visitors saw women winnowing wheat with wooden shovels. Despite great strides already made, Russian agricultural engineers still have a big job to do.

Increased emphasis is given to economic research aimed to reduce costs and raise production efficiency.

Big emphasis is on increasing production

Clearly, the Russians recognize their potentiality in agriculture and are taking energetic steps to increase production. Everywhere in the Soviet Union, our agricultural research is held up as a pattern. ☆

PARASITES CURB CANE BORER

Subtropical flies prove winter hardy and effective in Louisiana

■ COOPERATIVE RESEARCH by USDA entomologists, growers, and processors shows that sugarcane-borer parasites *can* be established and maintained in a limited area of the cane belt in Louisiana, where parasitization often reaches 50 percent.

The borer—most serious sugarcane pest in this hemisphere—lays its eggs on cane leaves. The larvae bore into the stalks, weakening them and interfering with nutrient translocation, and the tunnels provide a home for disease organisms. Parasites earn their keep by depositing maggots that develop and feed on the borers.

Infestations with borers cost us at least 12 percent of the sugarcane crop from 1935 to 1957, a loss adding up to millions of dollars.

Parasites released, checked

Cooperating growers bought pupae of Amazon and Cuban parasitic flies (*Metagonistylum minense* and *Lixophaga diatraeae*) from the British West Indies. ARS entomologists L. J. Charpentier, W. J. McCormick, and Ralph Mathes of the United States Sugarcane Insect Research Laboratory, Houma, La., hatched, mated, and released the flies and studied their performance. Parasites were released where there were enough borers in the right stage.

Nearly 2,500 Amazon and Cuban flies were released in preliminary tests in 1953 on 4 plantations. Thanks to a mild winter, both parasites colonized well and parasitized 36 percent of the borers that year. The Cuban fly did very well and in one field, where 93 had been released, parasitized 63 percent of the borers.

Additional parasites were released during the next 4 years on 11 plantations to increase the existing population and to develop a strain acclimated to local conditions.

The Cuban flies didn't overwinter as well in fields of dry, broken cane trash as in fields of the more nutritious unshaved summer plantings. Many flies survived temperatures of 23° F. in the latter fields.

In 1954, for example, the Cuban flies parasitized 75 percent of the cane borers in one field. This was done with an overwintering parasite population on an area that had received 548 parasites in 1953 and none in 1954. The same colony parasitized 46 percent of the borers in another field one-third mile away.

Flies' effectiveness maintained

Overwintering Cuban flies, reinforced with releases during the growing season, parasitized 87 percent of the borers in a field in 1955. More joints were bored in fields colonized for the first time that year than in fields that got an accumulated benefit from previous years' releases. Parasitization in 1956 was greater than in the previous 2 years.

Surveys to determine spread showed both parasites became established in fields up to 2 miles from the release point in the year of release. Tests are still underway to evaluate the effectiveness of the flies.

Several other parasites were used in the Louisiana tests with only moderate success. These were *Agathis stigmaterus*, a South American wasp now established in southern Florida; *Telenomus alecto*, a wasp of the West Indies and South America; and *Paratheresia claripalpis*, a Peruvian fly.

Borers continue to increase

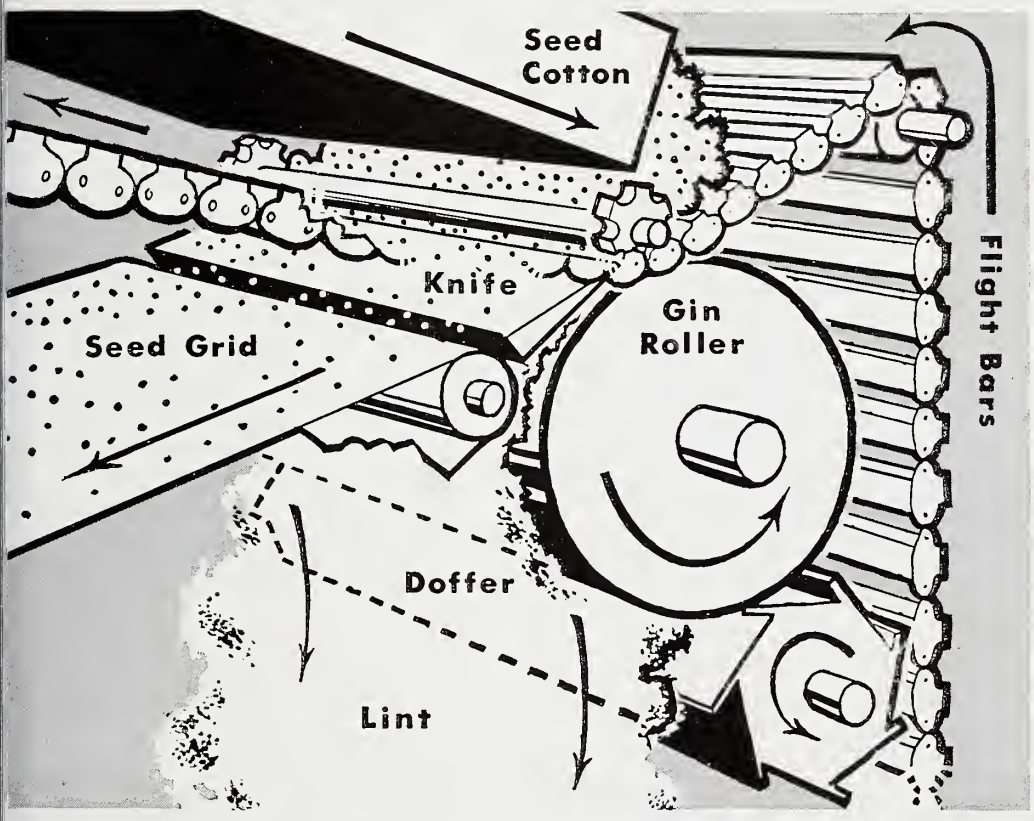
Borer infestations are generally increasing due to (1) more plantings of susceptible sugarcane; (2) more summer-planted cane, which usually harbors many overwintering borers; (3) more trash (containing borers) left in fields during harvest because of uneven topping by mechanical harvesters; and (4) a general labor shortage, which has limited scrapping (picking up small pieces of cane that may harbor overwintering borers).

Many kinds of parasites attacking the sugarcane borer have been tried out in Louisiana at various times. But the Cuban and Amazon flies represent the most successful effort. Weather conditions in Louisiana aren't generally favorable for biological control because the borer has a winter dormant period. In Florida and other areas where parasites are particularly effective, all stages of the borer are present and the parasites can breed continuously. ☆

CUBAN FLY pupae, developed by feeding on larvae of sugarcane borer, are shown in cane tunnel with dead host. Flies have performed especially well in tests.

RAPID FLIGHT-BAR GINNING

Innovation developed in ARS laboratory in Southwest ingeniously separates seed from lint at much faster gin speed than presently used



SLAT-LIKE "belt" of steel bars between two sprocket chains holds back the seeds as cotton reaches stationary knife. This action enables the roller to draw the lint from the seeds much more quickly than in conventional gins relying on vibrating knife to take out the seeds.

■ THE COTTON GINNING INDUSTRY is interested in a USDA-designed "flight-bar" roller gin that separates cottonseed from lint faster than conventional roller or saw gins in commercial use and does not damage the fiber.

The gin has recently turned out nearly 20 pounds of extra-long-staple lint per inch of roller per hour. Modern commercial roller gins average about 2½ pounds.

Capacity of the new gin in tests with shorter staple upland cotton was near 13 pounds. A commercial roller gin working similar cotton tested slightly more than 2 pounds. Modern saw-gin capacity is about 10 pounds.

James M. Williams, Jr., ARS engineer at the Southwestern Cotton Gin Research Laboratory, Mesilla Park, N. Mex., designed the new gin. A public patent has been applied for by USDA. This was done on the basis of a new ginning principle and favorable test results.

The innovation is the flight-bar attachment, replacing the vibrating knife used in conventional roller gins. Two endless chains with square steel bars as long as the ginning roller, fastened slatlike at 2-inch intervals, comprise the attachment. As seed cotton is fed into the gin from above, lint adheres to the ginning roller. A stationary knife, set close and parallel to the roller, holds back seeds as the lint is pulled by the roller. The chains, operated by sprockets, pull the flight bars across the knife. This efficiently removes seed as the fiber is pulled between the knife and the roller. Doffing the lint from the roller, by rotary brush or blast of air or steam, completes the ginning operation.

A recent adaptation has made the operating unit complete. Williams added a conventional blower to the gin. This enables return to the feeder of any mixed seed and lint that were not separated the first time through.

Extensive tests are planned to determine mechanical limitations of the gin, and cotton fiber and spinning qualities. Maximum practical roller speed and spacing and speed of the flight bars in relation to the roller speed for optimum efficiency must still be determined. ☆

RECHARGING UNDERGROUND RESERVOIRS

We're finding ways to store overflow water in the vast space below for use in time of need

■ WATER SUPPLY IS BECOMING an increasingly dominant factor in the development and growth of the Nation's agriculture, industry, and municipalities. Many areas suffer shortages because of little or no rainfall or because heavy seasonal flows waste into oceans or salt lakes or into areas with little or no need for additional water. Resulting heavy demands on wells in deficient areas have lowered water tables as much as 200 feet.

To meet this problem, Federal and State researchers are developing methods of recharging ground-water supplies. One project involves work at the Minter Field Spreading Ground near Bakersfield and in other localities in southern California. This work is being done by USDA, in cooperation with the California Department of Water Resources, the California Agricultural Experiment Station, and private industry, under the direction of ARS hydraulic engineer Leonard Schiff.

Both spreading and injection methods are tried

Recharge methods being tested include spreading water on fairly level land or in shallow basins to seep into the earth, and injecting water directly into the underground by means of trenches, pits, and shafts. Underground reservoirs have far greater water storage capacity than do all surface facilities combined.

To facilitate direct injection, 6 feet of shallow, less pervious soil in one pit was removed to uncover an 8-foot lens of coarse sand. The exposed area was 20 by 75 feet, or one twenty-ninth of an acre in area. The exposed surface was covered with a 6-inch layer of pea gravel to filter out suspended material in the water. The pit's average infiltration rate for river water for 82 days was about 44 times that obtained by spreading in basins. The underlying sand however, proved to be the filtering agent rather than the pea gravel. The sand became somewhat clogged with silt from the water, but scraping proved effective in recovering a high infiltration rate.

Direct injection through trenches also shows some promise. A half-acre trench with a surface of exposed soil ranging from sandy clays to sands left untreated during a 61-day run allowed an average of 11 feet of water per day to infiltrate. This half-acre trench gave the same infiltration rate as 4 acres of surface soils. Since suspended loads of clay and silt tend to deposit in a thin layer on top of sand, the bottom of the trench was periodically scraped and the initial infiltration rate was recovered as it was in the pit.

Recharging level surfaces or shallow basins often raises problems. Bare soils fine to medium in texture tend to clog owing to colloidal swelling, soil dispersion, microbial sealing, and silt deposit. The permeability of such soils has been increased many fold by treatments with vegetation, chemical soil conditioners, and organic residues such as cotton gin trash.

In one test on a large basin, gin trash was disked into the soil and wet and dried. Infiltration rates increased from 0.5 foot per day up to 1.5 feet per day. Less pervious subsurface soil layers, however, appear to limit further increases in infiltration rate.

In another shallow-spreading test, infiltration rates averaging 3.6 feet per day have been maintained for periods of several months at a time over a span of years on a fine sandy loam with good native vegetation. Researchers found that water with an occasional turbidity rate up to 25 cubic feet of sediment per acre-foot can quickly enter such a soil and penetrate to the reservoir. The grass cover in the area maintains an open, friable surface soil in spite of deposits of sediment.

Workers seek chemical to keep soil permeable

As another approach, the scientists are searching for a reliable chemical soil conditioner that can be added to the water to maintain original permeability of the soil as water seeps through it. Some work is being done with chemicals such as ferric sulfate, but thus far the results have proved short lived and expensive.

Research in this field is by no means complete. However, sufficient data are now available to justify the conclusion that recharging underground reservoirs is feasible, desirable, and necessary in some areas. ☆

SPREADING

1. Water is spread over 375-acre land surface divided into 10-acre basins, near Bakersfield.

2. Suitability of potential recharge site is gaged with help of infiltrometer, other tools.

3. Effect of chemical additive on infiltration rate of water is checked with infiltrometers.

4. Spreading and disking cotton gin trash into soil increased infiltration rate in one test.

INJECTION

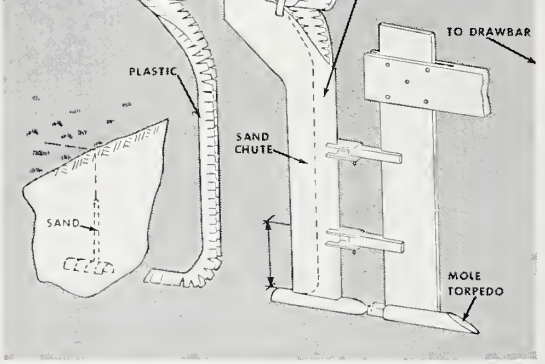
1. Sand bed is exposed 6 feet below relatively impervious surface soil in 1/10-acre test pit.

2. Water enters Bakersfield pit, where 6-inch experimental filter of pea gravel covers sand.

3. Clogging deposits must be removed or tied up by grasses, organic residues, or chemicals.

4. Injection shaft 4 feet in diameter and 20 feet deep is tested for rate of water injection.

PLASTIC LINER FOR MOLE DRAINS



MECHANISM built onto the mole-plow standard feeds plastic belt into new tunnel just behind the torpedo. Plastic, slit along edges to aid bending, is shaped into an arch as it leaves the tube. Coarse sand fills slit made by standard and improves drainage.

■ PLASTIC-LINED MOLE DRAINS can provide good subsurface drainage at a minimum of effort and lower cost than standard tile drains. The lined channels, developed cooperatively by USDA-State scientists and industry, fill a need for more flexible drainage methods for poorly drained soils.

Plastic-lined drains, installed and tested at the New York Agricultural Experiment Station, Ithaca, have served for 2 years without cave-ins, blockage, or filling in. These drains cost only about 8 cents a foot, installed, while conventional subsurface tiling costs considerably more. Conventional drainage calls for trenching, laying down bituminous, clay, or concrete tile, and allowing the fill dirt to settle before farming. The mole drain can be installed by machine without interruption to farming.

Lining mole channels with plastic is no more difficult than opening a mole drain, report ARS agricultural engineers C. D. Busch and T. W. Edminster. The plastic liner is laid as a mole plow opens the channel. Attached to the tractor's drawbar is a metal standard that pulls the mole torpedo. This torpedo opens and shapes the tubular drain at the bottom of the standard. Mounted on the standard is a spindle of rolled plastic sheeting. This vinyl strip, its edges slit at intervals in order to minimize stress, is formed into a tight "U" and fed down a chute that is attached behind the standard to guide the plastic into the mole channel. Tension unrolls the plastic into place as the channel is opened.

These simple, effective drains have already found use on wet lands where conventional subsurface drainage had been considered too costly. The liner has also been used for short laterals into outlet ditches.

To date, several types of liner shapes have been considered. Only a U-shaped roof was necessary for some conditions. A roof and a floor were formed simultaneously for other conditions. A complete cylinder was formed and sealed either mechanically or with pressure sensitive tape in other cases. The Louisiana, Florida, and South Carolina Agricultural Experiment Stations are cooperating in further engineering studies to adapt lined mole drains to various soils and land types. Further studies are planned for the Midwest and West. ☆

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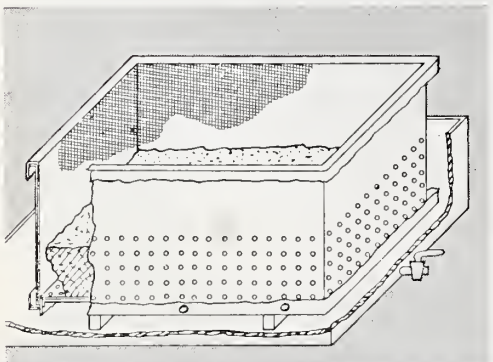
LABORSAVING WAY TO MAKE CHEDDAR CHEESE

■ A LITTLE CHANGE in the usual procedure for making Cheddar cheese may lower costs considerably. This change, developed by USDA's Eastern utilization division, promises to reduce total hand labor by half by eliminating tedious and costly handwork in matting and Cheddaring.

The USDA 7-hour method is followed, except that whey isn't drained as usual. Instead, the mixture of curd and whey is pumped into a cheesecloth-lined, perforated, curd-retaining form. Here the curd forms a layer under the whey, and most of the free air trapped between the curd particles comes to the surface and is released. Air retained in the curd causes holes in the cheese.



CURD, WHEY go into perforated form lined with cloth. Whey drains through holes. Cloth is folded over curd block; perforated top (not shown) is put on and weighted.

The cheesecloth liner is folded over the large block of curd and covered with a perforated top which is weighted down, and the whey is drained out of the tank. The curd is left to mat without being turned, eliminating the hand labor involved in the customary repeated handling and turning of small blocks of curd. After 2 hours the curd is cut into ¾-inch slabs for milling and handling in the conventional manner.

Cheese has the same general characteristics and composition when made experimentally by this method as when made conventionally. It has typical Cheddar flavor, few holes, and firm, pliable body. As it ages, flavor intensifies and the body becomes smooth and waxy. ☆

RESTING PASTURES REDUCES ROUNDWORMS

CATTLE BECOME INFECTED with heir common roundworms by grazng on pastures contaminated with inective larvae of these parasites. The dult female worms produce eggs that each the pasture with the manure of he cattle. The infective larvae then levelop from the eggs and can infect ither the same individuals or others hat are placed on the same pasture. This cycle can go on indefinitely, cutting down substantially on the vigor nd efficiency of production.

USDA is trying to find how to break his cycle by studies at the Agricultural Research Center, Beltsville, Md., nd the Regional Animal Disease Laboratory, Auburn, Ala. Researchers are learning how well infective arvae of these common cattle nemaodes develop and survive on pasture t different times of the year.

The Beltsville work has shown, for xample, that there is a progressive lecline in infectiousness of parasite-ontaminated pasture plots. In addition, more worm eggs develop into inective larvae on a pasture that's contaminated with manure in the spring rather than in summer, and more of the larvae live longer. Such basic information can go a long way to help formulate pasture management practices to control parasites.

Worm reduction is progressive

ARS parasitologists Aaron Goldberg and John Lucker deliberately contaminated 5 small pasture plots at Beltsville one spring with cattle feces containing about 95 million parasite eggs. Each plot was later closely grazed for 2 weeks by a calf that had been raised worm free. The number of worms recovered from the calves at autopsy varied with the time interval between contaminating and start of grazing of the plots.

Grazing a calf after a 3-week wait resulted in a very heavy infestation with worms; after a 2-month wait, only 32 percent as many; after a 4-month wait, 8 percent as many; and after 11 months, only 1 percent as many worms. This seems to suggest that resting pasture in similar climatic zones for as little as 2 months in late spring and summer will be beneficial for control of these worms, but that longer rests are necessary for more effective control.

The decline in infectiousness of the plots was also reflected in the calves' fecal egg counts, which decreased as the interval from contamination to grazing increased. The decline was also reflected in the difference in clinical effect of the infections on the calves. The first calf put out to graze became sick, lost weight, and was unable to stand on the day of autopsy. The second gained only slightly. But there wasn't any marked effect on weight gain for the rest of the calves in this study.

A much higher percentage of infective larvae survived for 2 months, and a slightly higher percentage for 4 months, than in a previous test. In the earlier test the pasture was experimentally contaminated in the summer rather than in the spring.

Larva behavior must be studied

Only a few *Haemonchus* larvae developed. Infective larvae of *Cooperia oncophora*, *Nematodirus helvetianus*, and *Ostertagia ostertagi* survived longer than those of *Trichostrongylus axei*, *Cooperia punctata*, and *Oesophagostomum radiatum*. Some larvae of the first two of these species and *Trichuris* eggs survived over winter.

Researchers say much remains to be learned about the behavior of infective larvae. It's especially important to study their vertical movement on plants under different regional environments and changes from day to day. We need to learn, for example, why larvae were present on the herbage in the tests, even during the final 2-week grazing, although almost no rain fell during this time. ☆

USDA Will Set Humane Slaughter Methods

LIVESTOCK-SLAUGHTER METHODS that are considered to be humane will be designated by Secretary Ezra Taft Benson by March 1, as required under the Humane Slaughter Act recently passed by Congress. A 12-member advisory committee recently appointed by the Secretary will assist in making this determination.

The Committee will recommend research to develop improved humane slaughter methods and will enlist cooperation of private and public organizations. Its members include representatives of national organizations of slaughterers, livestock growers, humane organizations, the trade-union movement, the poultry industry, a national veterinary medical organization, and the general public. One person familiar with the requirements of religious faiths with respect to slaughter was also included.

Packers who may offer products for sale to the Federal Government have until July 1, 1960, to adopt the methods. ☆

BROODER CONTROL BY ARTIFICIAL CHICK

This device reacts much like the birds it keeps comfortable

A NEW CONTROL that's responsive to radiant heat and automatically turns infrared brooder lamps on according to chick needs, has been developed by State-USDA scientists.

The heat-sensing element of this control is a sort of imitation chick. It operates under a brooder near chicks' body temperature and reacts as they do. This unique device is a 4-inch black globe that loses heat by radiation and convection in much the same way that chicks lose heat to their surroundings. Thus, a temperature change affecting the chicks also affects the control.

Globe reacts to radiant heat

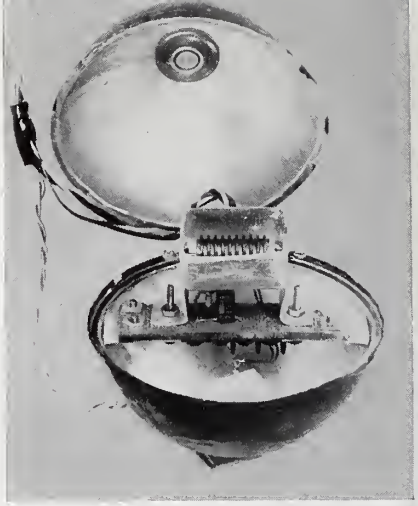
Chicks under a brooder normally lose heat because their bodies are warmer than their surroundings. A brooder regulates the rate of this loss by controlling environmental temperature, or by supplying radiant energy to the chicks from sources such as infrared lamps. The new research-developed control is more responsive to heat transfer by means of convection and radiation than are any of the presently used brooder controls.

G. M. White, a graduate student of Purdue University, Lafayette, Ind., and ARS agricultural engineer J. G. Taylor (deceased) collaborated to develop this device, which operates without greatly raising the temperature of the surrounding air.

The black globe is located just above the litter under the brooder lamp. The globe's 105° F. temperature is maintained with heat from two sources—some continuously through an electrical resistance element inside the globe; the rest, intermittently by the infrared brooding lamps.

As chicks get older, they produce more heat by eating more feed and become better insulated with feathers. Consequently, they need less heat from the infrared brooder lamps. The globe can't obtain heat in the same way. Instead, more internal heat is supplied through predetermined adjustments in a rheostat controlling voltage to the electrical resistance element in the globe. Increasing the globe's internal heat in proportion to chick age allows this unique little globe to maintain its internal temperature in progressively cooler surroundings without any additional heat from the infrared brooder lamps.

Suitable rheostat settings to make different-aged birds comfortable have been determined through tests based on accepted brooding temperatures. These settings are marked on the rheostat dial. In controlling infrared lamps, it's best to keep the "off" periods as short as possible, to keep chicks from getting chilled. This is done in the new control through what's known as a "proportional-time-cycle principle." This simply means that the thermostat setting continually sweeps back and forth across a band of about 30° F. every 15 seconds. Thus, when the sensing sphere's temperature is within this 3° range, the lamps are turned on for a portion of the 15-second cycle. The length of the "on" period decreases as the sphere's temperature approaches the upper limit of the 3° range. *Above* this range, lamps are off continuously; *below* this range, they are on continuously.



MOUNTED in black globe are thermistor (center), which senses temperature; resistance heating element, which supplies heat; and transistor, which amplifies it.

Unit serves several brooders

There are a few disadvantages to the new control. The fairly large sensing element occupies space under the brooder and must be protected from the birds. Rather complex servicing is required. Moreover, cost of the device is high, limiting it to large installations where one unit could control several brooders. ☆

RADIANT heat from infrared lamps keeps chicks warm. Artificial chick—small enclosed black globe—automatically turns on lamps when the chicks need more heat.

Precut Potatoes Handle Well

Seed producers and commercial growers both gain by lower production costs and better seed

■ CUTTING SEED POTATOES before shipment to growing areas, advocated for many years, is getting a thorough trial by USDA-State crop and marketing researchers. The practice may catch on with seedgrowers and potato farmers, because it seems both stand to gain.

Precutting reduces the number of acres needed to produce seed potatoes and lowers seedgrowers' costs. Precutting also saves potato farmers time and labor and maintains high seed quality and crop yield.

Precut seed can be delivered in good condition for storing or planting. But shipments need special controls, report Agricultural Marketing Service biologists H. W. Hruschka, W. L. Smith, Jr., and H. V. Toko. They worked out and tested controls to maintain in transit the right atmosphere for suberization—the growing of a new skin on cut surfaces. This healing keeps decay from getting into potatoes through exposed wounds.

Freely circulated warm, humid air in the rail cars or trucks, and agitation to keep seed pieces from sticking together, promote wound healing before loads reach their destination. To get this atmosphere, researchers made the test shipments in insulated railway cars equipped with circulating fans and alcohol burners. Car motion provided the agitation. Humidity was held above 90 percent by moisture from 2 sources: The burning alcohol and respiring potatoes. Uncovered floor racks under the sacked pieces helped air circulation.

Healed seed pieces in good shape for planting

Precuts are healed and ready for planting on arrival. Pieces may also end dormancy in the warm cars and begin to push tiny sprouts through the skin. This head-start gives the precuts a real advantage over freshly cut seed. Unhealed fresh-cuts may decay if planting is held up, or when cool, wet weather hits new plantings.

Significant cost savings are possible for seedgrowers and farmers with ready-to-plant potato seed.

It costs less to produce and market cut seed

Surprisingly, precuts can be marketed cheaper than small seed that farmers plant whole. This is true largely because the seedgrowers can cut and sell standard-size potatoes at a higher price than these bring when sold uncut. And the seedgrower can cut the larger potatoes more cheaply and with less risk than he can grow extra acreage (at high cost) for enough small whole potatoes. From cooperative shipping tests by AMS and Eastern States Farmers' Exchange, researchers estimate precuts require half as much seed acreage to supply farmers who formerly used whole seed. Furthermore, the Exchange machine cut seed for about $100 a carload cheaper than farmers could do it individually.

Farmers gain in reduced labor costs and improved stands and yields, ARS horticulturist R. V. Akeley says.

Rotting in storage and ground were kept low in test plantings in 1955 and 1956. In a Maine test, 8 varieties were cut and stored as long as 9 months. Healed precuts were shipped for cooperative test planting by the agricultural experiment stations of Wisconsin, Connecticut, New Hampshire, South Carolina, and Maine.

Seed-piece decay was reduced in many cases. Storage periods had little effect on yields from these plantings. Both early- and late-maturing varieties yielded well. For example, yields from Sebago potato seed cut and stored for 5 months before planting in South Carolina, were higher than yields from freshly cut potatoes.

New shipping and yield tests—plantings of several varieties are to be made in Florida, North Carolina, New York, and Maine—will show us how well precut potatoes meet the needs of the various growing areas. ☆

AUTOMATIC CUTTING before shipment to farmers saves time, labor costs (as much as $100 a carload cheaper), gives growers more uniform seed.

INSTRUMENTS RECORD en route two special shipping conditions for wound healing: High temperature and humidity.

HEALED PRECUTS with new skin handle like whole seed, ready to plant or store on delivery.

NEMATODE SPREADS A PLANT VIRUS

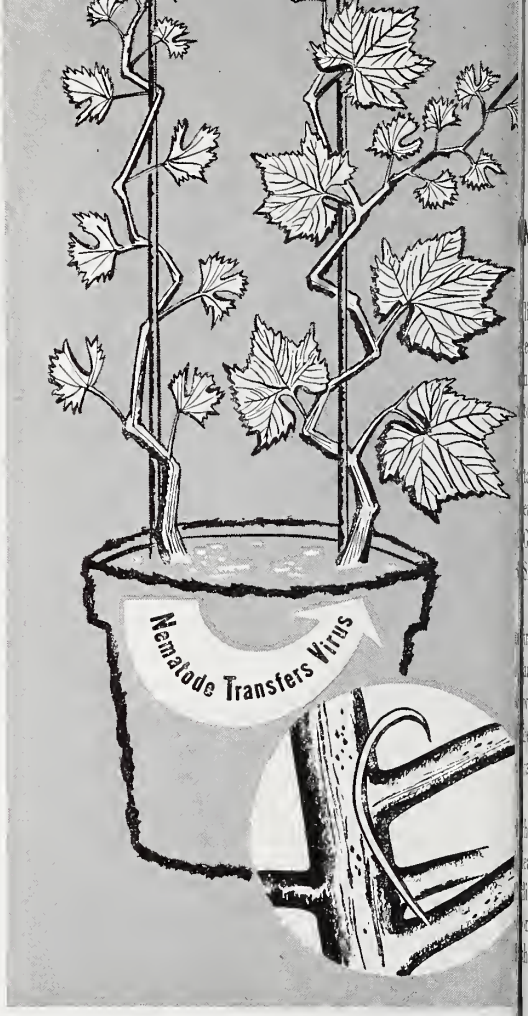
■ A DAGGER NEMATODE known to be a destructive plant parasite has been caught in the new role of plant virus carrier. In USDA-State studies, the nematode *Xiphinema index* transmitted fanleaf virus of grapevine from infected to healthy plants.

This discovery makes other similar plant parasitic nematodes suspect. Further tests will be made to determine whether these tiny eelworms spread other soilborne viruses.

No nematode had previously been proved a carrier of plant viruses. But plant pathologist W. B. Hewitt and nematologist D. J. Raski at the California Agricultural Experiment Station, Davis, rightly linked this dagger nematode to the slow spread of fanleaf from infected to adjacent healthy vines. Experiments that followed proved Hewitt and Raski right. They worked with ARS plant pathologist A. C. Goheen to identify the carrier.

In one experiment, healthy grapevines and fanleaf-diseased vines were planted in the same clay pot. The healthy vines—infested with this dagger nematode (from the root zone of disease-free grapevines)—developed fanleaf in 10 months. In another study, similar results were obtained using dagger nematodes from a fig tree's root zone. All control vines remained healthy.

Discovery that the dagger nematode transmits the fanleaf virus suggests that control of this nematode in vineyards will prevent spread of the virus. But no satisfactory method has been found for controlling the nematodes around the roots of living grapevines. It is possible, of course, to control nematodes in soil before new vineyards are planted or before replanting. While this is an excellent practice for other reasons, its value in controlling fanleaf disease has not been established. ☆



HEALTHY VINE'S deformed new growth (top right) shows nematodes have carried virus from diseased vin

HOW THRIPS GET IN

■ HEAVY MIGRATIONS of flower thrips (*Frankliniella tritici*) in spring and summer damage many garden flowers in the East. These insects also get into greenhouses and damage roses, carnations, and chrysanthemums.

USDA research at the Agricultural Research Center, Beltsville, Md., is showing exactly how thrips get into a greenhouse and how they can be controlled. For the past two summers, ARS entomologists T. J. Henneberry, F. F. Smith, and E. A. Taylor trapped these insects in a greenhouse to determine their movement. Cards coated with a sticky substance were placed in the top and side ventilator openings. One set of cards faced west to catch the thrips as they entered with the prevailing wind, and the other faced east into the greenhouse to catch those leaving.

More thrips were caught in the top than in the side ventilators, and as many were caught leaving as entering. This movement through top ventilators is apparently aided by wind currents and by convection due to heated air inside the greenhouse. The major damage to hothouse flowers, though, comes from the thrips that get in the side ventilators. Fewer get in this way, probably due to lack of convection currents close to the greenhouse floor and the greater distance between side ventilators. But even fewer leave on the opposite side.

These studies show that it's important to screen the side ventilators to keep out thrips, but there's little need to screen the top openings. Limited tests also indicate that thrips and other insects get into greenhouses through the special pads of a new system for cooling in the hot summer months. (This system cools by drawing air by fans through wet evaporative-type excelsior pads.) ☆

Malaria mosquitoes next?

Releasing male mosquitoes sterilized by irradiation with cobalt-60 is experimentally effective in reducing numbers of malaria-carrying mosquitoes, USDA scientists report.

About 80-percent control was obtained in laboratory tests by ARS entomologists A. N. Davis, J. B. Gahan, D. E. Weidhaas, and C. N. Smith, working in Orlando, Fla.

The method holds promise in controlling some malaria-carrying species and may be useful in combination with other control measures. It may be effective in getting survivors that can't be eradicated any other way.

Successful eradication in 1955 of the screwworm from Curacao by release of irradiated male screwworm flies encouraged laboratory research on *Anopheles quadrimaculatus*, one of the numerous malaria carriers.

Blacklight—chafer lure

Fluorescent blacklight traps that have been specially adapted to attract European chafer beetles may be the most effective means of determining

quarantine areas for this pest of small grain, hay, and pasture crops.

The chafer beetle has been successfully contained by Federal quarantine since 1955 in limited areas of New York, Connecticut, and West Virginia, but a better way was needed to check the extent of beetle infestation (AGR. RES., March 1955, p. 16).

ARS entomologists H. Tashiro and E. L. Tuttle made the breakthrough at Geneva, N. Y., in cooperation with New York Agricultural Experiment Station. Blacklight traps developed by ARS agricultural engineers and used to attract other night-flying insects were tested and modified for use on chafer beetles. These traps captured up to 70 times more beetles than chemically baited traps and were effective during both evening and morning flying periods. Chemically baited traps usually are effective only about 30 minutes around sundown.

Belt trough is moving

A USDA-developed belt-trough dehydrator useful for drying fruits and vegetables to low moisture levels is finding commercial acceptance (AGR. RES., December 1954, p. 4).

Several California firms have adopted the dryer for conventional vegetable dehydration and for dehydrofreezing (drying-freezing) pimientos. The dryer's also undergoing trial for dehydrating apples in Washington and dehydrocanning (drying-canning) apples in New York.

The fast and uniform-drying dehydrator is a development of the ARS Western utilization division, Albany, Calif. The freezing and canning processes were also developed there.

The dryer consists mainly of a broad, moving wire-mesh belt forming a trough. Fresh product is fed into one end. Pieces are thoroughly mixed and dried by constant motion of the belt and heated air blown up through a grate underneath. Uniform drying assures uniform rehydration.

Learning about radiation

A series of 2-day radiological monitoring courses is being offered in USDA by the ARS Meat Inspection Division. Courses cover atomic vocabulary and give specific instruction in calibrating, computing, and using radiation detection equipment.

The Meat Inspection Division has been training its inspectors through similar courses since 1951, to safeguard our meat supplies against radioactive fallout—either accidental or due to enemy action. Similar training is now available for other Department personnel to build up a core of individuals ready to assume predetermined responsibilities in handling agricultural emergencies. Officials are planning to expand the courses to include field personnel.

Courses were organized by R. K. Somers, Chief Division Staff Officer for Procedures and Training, aided by J. D. Lane and R. P. McCoy, Jr.

Take some corn starch . . .

A versatile new corn starch derivative developed by USDA promises many industrial applications, from oil-well drilling muds to cosmetics.

Crosslinked dicarboxyl starch—as the material is called—was developed at the ARS Northern utilization division, located at Peoria, Ill.

The new starch may be valuable as a thickening agent in various paste-like products, and in the making of paper, paints, textiles, food products, toiletries, and other items.

Finding ways of chemically treating starch to change the way it responds to water and heat is one aim of starch utilization work at Peoria. Crosslinked dicarboxyl starch is one of the latest developments.

A thick paste results when ordinary corn starch is dissolved in water and boiled. When the starch cools, it jells and can't be poured. This makes starch unsuited for many industrial uses. First step in producing the new

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starch is a chemical process known as crosslinking, which retards water uptake and swelling. Enough crosslinks can be added to keep starch from swelling, even at temperatures above the boiling point of water. Such modified starches have been produced for use as dusting powders.

Another chemical treatment makes the starch acid. This increases its

ability to absorb water and to swell when heated. But at the same time, the crosslinks hold the starch molecules together and help them resist jelling. Heating this modified starch in water with other materials produces a variety of pastelike products that have extremely high viscosities but do not jell when cooled.

They're ready to go

Two new USDA facilities—a national seed repository in Colorado and a fruit and vegetable products laboratory in Florida—were dedicated in special ceremonies last month.

The National Seed Laboratory on the campus of Colorado State University at Fort Collins will store thousands of plant seeds for use as breeding stock. These seeds represent the world's most valuable food, feed, pasture, fiber, and tree crops.

The Fruit and Vegetable Products Laboratory at Winter Haven will do research to extend the utilization of fruits—especially citrus and other subtropical fruits—and vegetables. This laboratory is part of the ARS Southern utilization division.

Tighter pest controls

New Federal regulations, effective November 24, 1958, extend stricter control over shipment of all plant pests, including insects, mites, nematodes, protozoa, bacteria, fungi, parasitic plants, and viruses.

Issued under the Federal Plant Pest Act of 1957, the new regulations supplement earlier restrictions on injurious insects and mollusks. Permits are required for importation and interstate shipment of pests. Inspection and other regulation of transportation, products, and articles that may carry pests are authorized.

Full details of the regulations, which affect shipments of biological specimens and other materials by scientists, collectors, supply houses, and others, were published in the October 24 Federal Register.

No need for hormones

Beltsville small white turkeys don't seem to need hormone treatment to be better finished broilers than treated broad-breasted large white turkeys, say USDA researchers.

Tests showed the finish of hormone-treated and untreated small Beltsville birds at 16 weeks was grade A—much better than that of the bigger broad-breasted birds at 13 weeks. These latter birds didn't acquire a grade A finish at 13 weeks with or without hormones. But the hormone improved finish more in the large birds than in the small whites.

ARS poultry husbandman S. J. Marsden and poultry nutritionists J. J. Miner and C. A. Denton, of the Agricultural Research Center, Beltsville, Md., began the 3-week hormone treatments when the bigger birds were 10 weeks old and the smaller ones were 13 weeks old. Synthetic female hormones—dienestrol diacetate and diethylstilbestrol with methimazole—were injected or given orally. Added fat was given to birds in 1 of the 8 test pens. Birds were slaughtered at the usual age—13 weeks for bigger

birds, 16 weeks for the smaller ones. Effects of hormone treatment on feed conversion, weight gain, and finish for marketing as broilers were compared.

Finish on the small whites given extra fat was slightly better than that of untreated controls, although the extra fat didn't have much effect on final weight. On the other hand, extra fat in the diets of broad-breasted birds greatly increased weight.

Feed conversion of hormone-treated birds of both types wasn't as good as that of untreated birds. Added fat in diets considerably improved feed conversion of both types.

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